

when attempting to explain the effect of environment on man, as the following extract will also prove.

"It has been shown that the precursor was most probably furry, with a woolly under and a sleek outer coat, and it is conceivable that in a volcanic environment like that of Java, it might have been advantageous to shed the wool and retain the sleek hair, together with all the other physical characters of the primitive Negrito."

The white race (*Homo Caucasicus*, as Mr. Keane delights to term it) is held by the author to have evolved in, and dispersed from, North Africa; but he strangely omits to refer to Dr. D. G. Brinton, who, in his "Races and Peoples" (1890), had already promulgated that view.

It is evident that Mr. Keane is a very diligent and widely-read literary man, but he is decidedly weak on the scientific aspects of his subject. Lastly we must criticise those figures which were copied from the author's "Types of the Races of Mankind," in Longmans' New Atlas. The process-blocks from these lithographs have a very coarse appearance, and offer a marked contrast to those taken from photographs. On the whole, the selection of the illustrations of racial types is well made.

Although there is a good deal of what may be termed contentious matter, besides numerous errors, in Mr. Keane's book, we can recommend it as a most useful introduction to a very complicated study; and as the author has brought together and abstracted a large number of references, the student can use the book as a point of departure, and thus it will serve as a base for a more extended or detailed survey of this really important branch of science.

A. C. HADDON.

RIGID DYNAMICS.

An Elementary Treatise on Rigid Dynamics. By W. J. Loudon, B.A., Demonstrator in Physics in the University of Toronto. Demy 8vo, pp. ix + 236. (London: Macmillan and Co., 1896.)

THERE are few mathematicians who do not vividly recollect the difficulties they experienced when reading "Rigid Dynamics" for the first time. Mr. Loudon's treatise does much to smooth away these difficulties; and if it still leaves undone much that might have been done in simplifying the subject for beginners, it nevertheless fills a gap the existence of which has long been felt among teachers.

From a purely mathematical standpoint, we have none but praise to offer. As a digest of the earlier matter of Dr. Routh's treatise up to, but not including, Lagrange's generalised equations of motion, it will be welcomed by all students whose primary object is to master the equations of motion of a rigid body without diving too far into higher applications.

The order of treatment is essentially based on "Routh," with the exception that Mr. Loudon gives no separate chapters on "Motion in Two Dimensions," "Momentum," and "Vis Viva." Thus the first two chapters deal with "Moments of Inertia" and "Ellipsoids of Inertia," and are followed by chapters on "D'Alembert's Principle" and on "Motion about a Fixed Axis." After the latter problem has been considered both for finite and "impulsive" forces, the same is done for motion about a fixed point. In this connection, the equations of motion

of a top, and of a body moving under no forces, are discussed as far as they can adequately be treated without using elliptic functions. The book concludes with a chapter on the "Gyroscope," in which the experimental proof of the earth's rotation is figured and described at some length.

One very commendable feature is the large number of diagrams. To represent on paper three planes at right angles in a rigid body is a task which previous writers have shirked; but Mr. Loudon's large and bold figures will do much to assist the reader in forming a concrete idea of the motions he is dealing with. We might instance more especially Fig. 50, illustrating the motion of a top spinning on a horizontal plane, and Fig. 58, illustrating how the motion of a rigid body under no forces is completely represented by the rolling of the momental ellipsoid on a fixed plane.

To our mind the book's chief drawback, considered as an *elementary* treatise, lies in the author having, no doubt unconsciously, followed Dr. Routh's analytical methods too closely instead of striking out in simpler lines of treatment. That it is a useful exercise to start every problem by writing down the fundamental equations

$$\Sigma m \frac{d^2x}{dt^2} = X, \quad \Sigma m \left(y \frac{d^2z}{dt^2} - z \frac{d^2y}{dt^2} \right) = L$$

cannot be doubted, but the ordinary beginner often finds it hard to proceed from these equations to the final solution. What he now chiefly requires is a thorough grasp of the nature and significance of "angular momentum." We by no means wish to overrate the educational value of the familiar type of Tripos rider, whose solution merely involves writing down the equations of conservation of angular momentum and energy, and eliminating between the two; at the same time, we do think that much may be learnt from problems of this class, especially by the beginner. For a similar reason we are sorry not to find "Motion in Two Dimensions" treated earlier. Again, in deducing Euler's equations of motion, it seems a pity that the author has adopted Dr. Routh's laborious proof, a proof which is always found very hard to grasp. Its difficulty is largely due to the necessity of proving the relation

$$\frac{d\omega_1}{dt} = \frac{d\omega_x}{dt}$$

connecting the rates of change of the angular velocities about fixed and moving axes respectively. The author gives two proofs of this identity, occupying four pages of difficult mathematics; but the result is, after all, only a particular case of the general property of moving axes, which, when applied to any *other* vector quantity (angular momentum, for example), assumes the far more intelligible and suggestive form

$$\frac{dh_x}{dt} = \frac{dh_1}{dt} - h_1\omega_3 + h_3\omega_2$$

and thus leads to a far shorter proof of Euler's equations.

In a few respects the book slightly lacks in finish. A tyro might easily complete the chapter on "D'Alembert's Principle" without having his attention drawn to what that principle really is, or might even mislead himself into the impression that the principle consisted in the mere equations

$$\Sigma (f_1) = \Sigma (f_2) = \Sigma (f_3) = 0.$$

Again, on p. 127, the author commences to explain the "sleeping" of a top, but stops short after briefly indicating that the effect is due to friction. It would require considerable mathematical ability to prove the phenomenon by actually integrating the equations of motion, taking account of friction in the manner suggested.

Most people find it easier and quite as effectual to explain the observed results from general principles.

Such difficulties would mostly disappear in the hands of an accomplished teacher. Moreover, the volume is exceedingly rich in examples, both illustrative and otherwise, and, in addition to those contained in the text, there is a collection of 300 problems at the end. As a class-book, or for use in the lecture-room, Mr. Loudon's treatise may therefore be safely recommended. G. H. B.

OUR BOOK SHELF.

Our Country's Butterflies and Moths, and how to know them. A Guide to the Lepidoptera of Great Britain. By W. J. Gordon, author of "Our Country's Birds," "Our Country's Flowers," &c. With a thousand examples in colour by H. Lynn, and many original diagrams. Crown 8vo, pp. vii + 150, plates 32. (London: Day and Son, 1896.)

ONE remarkable circumstance noticeable in the present plethora of works on British butterflies and moths, is that almost every new one is composed on a different plan. The present book reminds us a little of Wood's "Index Entomologicus," except that the figures are not reduced; and it will be very useful to schoolboys commencing a collection. All the *Macro-Lepidoptera* are figured, to the *Geometridæ* inclusive, and all the genera of *Micro-Lepidoptera*, except in the *Tineæ*, where the selection is limited to typical specimens of each family. The execution, though unequal, is fairly good on the whole, and most of the species figured will be easily recognised, though the want of figures of undersides, and of both sexes in the butterflies will be severely felt in many cases. One or two of the figures are, however, so unlike the insects they are supposed to represent, that our first impression on opening the book was that they were intended to represent some foreign species. We may specially instance the figure of *Sphinx pinastri* on plate 7, while that of *Smerinthus populi* is not much better. But this matters less in the case of conspicuous and easily identified species; and where accuracy is really needed, as in the smaller *Geometridæ*, the execution is much better. The letter-press largely consists of indices and tables, and contains much useful information relating to *Lepidoptera*, and even to insects in general. The main characteristics of the families, genera and species are briefly noticed, as well as their sizes and times of appearance, but nothing is said about localities or comparative rarity. Notices of the larvæ are limited to those of the butterflies; English as well as Latin names are used throughout. It is only fair to the author to say that we have rarely seen a book in which so much information was compressed into so small a space.

Handbook for the Bio-Chemical Laboratory. By Prof. John A. Mandel. Pp. 101. (New York: John Wiley and Sons. London: Chapman and Hall, Limited, 1896.)

IN this handbook will be found detailed descriptions of the methods of preparation of the most important substances which enter into the composition of the fluids and tissues of the animal body, and a synopsis of the tests for such substances, arranged in alphabetical order. Students of physiological chemistry will find the volume a handy laboratory manual.

NO. 1382. VOL. 53]

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Buried Celluloid.

It has occurred to many people, that perhaps celluloid might be useful as an insulator for electric cables. I feared it might deteriorate. I have made an experiment of 4½ years duration which may be of use in connection with the subject. On August 15, 1891, I took four photographic quarter-plate celluloid plates, with the gelatine removed, and treated them as follows:—

No. 1 was nailed to an outhouse, and became rotten in a year.

No. 2 was 1 foot deep in garden soil.

No. 3, 1 foot deep in gravel.

No. 4, 1 foot deep in a rubbish heap.

The last three were dug up on April 6, 1896. Nos. 2 and 4 were in as perfect condition as ever. No. 3 has some sand rubbed in, but is perfectly sound.

The experiment was made at Pitlochry, N.B. The specimens can be seen at my office.

GEORGE FORBES.

34 Great George Street, Westminster, S.W., April 16.

Suggested Photography by Transmitted Heat Rays.

I AM no chemist, and may be mistaken, and what I propose would be more curious than useful; but I believe it would be possible to get a visible shadow of a small object which was concealed from sight by being enclosed within an opaque material. There are substances opaque to light, but which transmit the rays of heat; most readily, I suppose, those from the sun, and these are substances on which such heat rays impinging would cause some visible change.

If the heat-transmitting substance allows the rays to pass without dispersion, preserving their rectilinear direction, then these rays falling upon a duly prepared screen would cause a visible change upon a portion of its surface; and any ordinary opaque object placed within the heat-transmitting substance would cast a shadow, dark, or bright, as the case may be.

Penzance.

REGINALD COURTENAY.

Influence of Terrestrial Disturbances on the Growth of Trees.

As the subject of forestry has recently been much under discussion, and appears to be exciting more interest in this country than it was, I trust I shall not be trespassing upon your space in calling attention to a peculiar case of timber growth which I have noticed, and in soliciting the opinions of those of your readers who are likely to be well-informed upon foreign woods, as to its true cause.

There is in the British Museum of Natural History the cross-section of a large Douglas fir grown in British Columbia, and stated to be more than 500 years old at the time it was felled, which was, I believe, in 1885. An attractive feature in the section is that the annual rings have been marked off chronologically, and some historical event, contemporaneous with the growth of the ring to which the date is attached, is given.

A glance, however, at one part of the surface of the wood, which is polished, reveals a very remarkable modification of the annual rings, which appears to have taken place towards the close of the first century of the tree's existence. About twenty of the rings are there crowded so closely together as to present, at a short distance, the appearance of a zone about three-quarters of an inch wide running round the trunk, and differently coloured from the rest of the wood. It is also to be particularly observed that the change to ordinary growth on either side of the zone is abrupt; and, further, that no such phenomenon is afterwards presented during the many centuries of the tree's subsequent development.

The suddenness of the changes puts out of court the idea that the check to growth might have been due to overcrowding in the forest during the period of the struggle for supremacy over its fellows, which the tree would undergo, because any effect from this cause would only come on gradually, and diminish in the same manner.

The supposition that twenty bad seasons occurred in succession, is unlikely under any climatic conditions with which we are